

Results of Medication Questionnaire #1

Kenneth P. Fishkin, Intel Research Seattle
Sunny Consolvo, Intel Research Seattle

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Introduction

At Intel Research Seattle, we have been investigating ways to aid people with their medication-taking, in the home environment. To do this usefully, we need to have some understanding of the current contexts and usage scenarios in which people take their medications: where they take them, when they take them, how they take them, what aids they would like in taking them, and so forth. For example, when designing a system to monitor pill-taking, some immediate questions arise, such as:

- ☐ Where do people keep their pills?
- ☐ Do people share their pills with others in the house?
- ☐ What percentage of their medications are in pill form?

The answers to questions such as these have a dramatic impact on the design of any useful system.

In pursuit of this goal, we conducted a questionnaire asking people about their medication usage. The results are presented in this report.

We first briefly describe the method, and then present the answers to each question in the questionnaire, with some analysis/summarization interspersed. After that, we discuss some of the implications of the data for designers of medication monitoring systems. Appendix I then contains the original questionnaire.

Method

Participants were handed a 6 page questionnaire, and told to return it at by March 28th. Participants were compensated for their time with a \$5 gift certificate for Starbucks coffee.

Participants were recruited from four primary pools:

1. Family, friends, and employees of Intel Research Seattle
2. Graduate students in Computer Science at the University of Washington
3. Members of a nearby fitness club
4. Members of a nearby pilates studio

Participant were only required to have one attribute: that they took at least one medication (including vitamins), per week.

The first page of the questionnaire gave instructions. The last page allowed participants to optionally give their contact information, in case we had further questions. When we received the questionnaires, the first page was discarded. The questionnaire was then numbered. If the participant gave contact information, that number was copied onto that page, which was then stored in a locked cabinet. Otherwise, the contact page was discarded. Once this process was completed, no-one looking at the database could match participant number to contact information.

The complete questionnaire is included as Appendix I.



The questionnaires were disseminated through the month of March, with the last one received back on March 28th. A total of 53 questionnaires were received. Not all questions were answered by all participants, so for each question the number of answers is denoted as N .

Notation

As we go through the questionnaire, the original questions are in large, bold, italic font, for example:

What is your favorite color?

Any possible listed answers to the question are in a grayish font, for example:

- ☐ Red
- ☐ Yellow
- ☐ Blue

Any answers written in by participants are in italics, for example:

purple



The Questionnaire and its Results

1. Your gender:

$N = 51$:

- ☐ Male: 20 (39%).
- ☐ Female: 31 (61%).

2. How old are you?

$N = 53$:

- ☐ younger than 18 0 (0%).
- ☐ 18-21 4 (8%).
- ☐ 22-26 12 (23%).
- ☐ 27-30 5 (9%%).
- ☐ 31-34 8 (15%).
- ☐ 35-38 2 (4%).
- ☐ 39-42 1 (2%).
- ☐ 43-50 3 (6%).
- ☐ 51-60 9 (17%).
- ☐ 61-70 5 (9%).
- ☐ 71 or older 4 (8%).

Discussion of question 2

The bimodal distribution is due to the nature of our participant pool. We knew we were getting a lot of graduate students, and so tried to balance that by sending questionnaires to older relatives.

The mean age cannot be reliably determined due to the “binning” of the ages, and the presence of the “71 or older” category. The median is 31-34.

3. Where do you live? (City & State)

We show the States, alphabetically, and then the cities within each, $N = 52$:

- ☐ California - 3
 - Menlo Park (1)
 - Santa Clara (2)
- ☐ Illinois – 1
 - Chicago
- ☐ Indiana – 1



- Goshen (1)
- ☐ New York – 1
 - Schenectady (1)
- ☐ Oklahoma – 1
 - Oklahoma City (1)
- ☐ Virginia – 10
 - Alexandria (1)
 - Arlington (2)
 - Ashburn (1)
 - Bracey (1)
 - Falls Church (1)
 - Round Hill (1)
 - Stafford (1)
 - Virginia Beach (2)
- ☐ Washington – 34
 - Arlington - 1
 - Puyallup – 1
 - Sammamish – 1
 - Seattle – 29
 - Shoreline – 1
 - <no city supplied> - 1
- ☐ Wisconsin – 1
 - Madison – 1

4. What best describes your status (check only one):

N = 53:

- ☐ Full-time employed 19
- ☐ Part-time employed 4
- ☐ Unemployed 0
- ☐ Homemaker 2
- ☐ Retired 12
- ☐ Student 16

5.1. In a typical week, how many different medications do you take on a regular schedule?

N = 53:

- ☐ 0: 1
- ☐ 1: 9
- ☐ 2: 10
- ☐ 3: 11
- ☐ 4: 5
- ☐ 5: 11
- ☐ 6: 3
- ☐ 8: 2
- ☐ 9: 1



The mean is 3.36

5.2 How many are prescription medications?

$N = 53$

- ☐ 0: 13
- ☐ 1: 17
- ☐ 2: 12
- ☐ 3: 6
- ☐ 4: 2
- ☐ 5: 3

The mean is 1.55, or roughly 46% of the overall regularly taken medications.

5.3 How many are over-the-counter medications?

$N = 53$

- ☐ 0: 35
- ☐ 1: 11
- ☐ 2: 3
- ☐ 3: 3
- ☐ 7: 1

The mean is 0.62, or roughly 18% of the overall regularly taken medications.

5.4 How many are vitamins?

$N = 53$

- ☐ 0: 18
- ☐ 1: 14
- ☐ 2: 10
- ☐ 3: 6
- ☐ 4: 3
- ☐ 5: 1
- ☐ 7: 1

The mean is 1.43, or roughly 43% of the overall regularly taken medications.

Discussion of question 5.

Our intent was that the numbers entered in 5.2-5.4 would equal the total of 5.1, and this was the case for 49 of the 53. However, in 4 of the questionnaires, the sum was greater than the total, as follows:

- ☐ Participant 27: 2 prescription, 3 o.t.c., 2 vitamin, total of 5.
- ☐ Participant 28: 3 prescription, 3 o.t.c., 2 vitamin, total of 6.
- ☐ Participant 39: 2 prescription, 3 o.t.c., 3 vitamin, total 5.
- ☐ Participant 41: 2 prescription, 7 o.t.c., 4 vitamin, total 9.

In each case, the total the participant entered was the total if vitamins were not included in the total, but this may be coincidence. Accordingly, we have left the data as the participants entered it.



6.1 In a typical week, how many different medications do you take on an “as-needed” basis?

$N = 53$

- ☐ 0: 16
- ☐ 1: 19
- ☐ 2: 12
- ☐ 3: 6

The mean is 1.15, participant take roughly 3 times as many medications regularly as they do “as-needed”.

6.2 How many are prescription medications?

$N = 53$

- ☐ 0: 44
- ☐ 1: 6
- ☐ 2: 3

The mean is 0.45, roughly 39% of the as-needed total

6.3 How many are over-the-counter medications?

$N = 53$

- ☐ 0: 25
- ☐ 1: 22
- ☐ 2: 5
- ☐ 3: 1

The mean is 0.66, roughly 57% of the as-needed total

6.4 How many are vitamins?

$N = 53$

- ☐ 0: 42
- ☐ 1: 7
- ☐ 2: 2
- ☐ 3: 2

The mean is 0.32, roughly 28% of the as-needed total

Discussion of question 6

As in question 5, we had thought that the sum of the answers to questions 6.2 through questions 6.4 would equal the answer to question 6.2. In 51 of the 53, this was the case.

In two, it was not:

- ☐ Participant 25: 2 prescription, 1 o.t.c., 1 vitamin, 3 total
- ☐ Participant 28: 2 prescription, 1 o.t.c., 1 vitamin, 2 total

Discussion of questions 5 and 6

A few summarizing statistics from looking at the answers to questions 5 and 6 together:

- ☐ Roughly 25% of the medications are taken on an “as-needed” basis.
- ☐ Roughly 39% of the medications taken are vitamins.
- ☐ The mean of the total number of medications taken in a week is 4.51



7. For the different medications you take in a typical week, whether regularly or as-needed, how many...

a) come in a bottle?

$N = 53$

- ☐ 0: 4
- ☐ 1: 5
- ☐ 2: 13
- ☐ 3: 8
- ☐ 4: 9
- ☐ 5: 6
- ☐ 6: 7
- ☐ 9: 1

The mean is 3.24

b) come in a blister pak?

$N = 53$.

- ☐ 0: 33
- ☐ 1: 17
- ☐ 2: 3

The mean is 0.43

c) come in some other packaging?

$N = 53$.

- ☐ *tub* or *big tub*: 2
- ☐ *powder*: 1
- ☐ *#10 size plastic*: 1
- ☐ *pull backtab*: 1

The mean is 0.09

d) are liquid?

$N = 53$.

- ☐ 0: 51
- ☐ 1: 1
- ☐ 2: 1

The mean is 0.06

e) are also used by someone else?

$N = 53$.

- ☐ 0: 43
- ☐ 1: 5
- ☐ 2: 4
- ☐ 3: 1

The mean is 0.30

Discussion of question 7

The sum of the packaging options in questions 7(a) through 7(c), 3.76, is well below the total number of medications taken (4.51, from questions 5 and 6). We are not sure how to



explain this discrepancy, except that perhaps people aren't sure which forms their medications come in.

A few other summary statistics:

- ☐ Bottles represent 86% of the packaging.
- ☐ Blister paks represent 11% of the packaging.
- ☐ The other forms of packaging represented roughly 3% of the total. No syringes or nasal sprays were mentioned, this may be due to the smallness of the sample.
- ☐ Of the 4.51 medications taken, only 0.06, only a little over 1%, come in liquid form.
- ☐ Of the 4.51 medications taken, 0.30, roughly 7%, are shared. Our intuition was that this number would be higher, because of shared vitamins, aspirin, etc.

8. In which room(s) do you keep your medications? (check all that apply)

$N = 52$.

- ☐ In the bathroom 27
- ☐ In the kitchen 26
- ☐ In other rooms
 - Bedroom: 13
 - Living room: 2
 - Hallway: 2
 - Living room closet: 1
- ☐ In no particular room 1

The sum is greater than N because users could check multiple locations. 38 users checked exactly one location, broken down as follows:

- ☐ Only in the bathroom: 16
- ☐ Only in the kitchen: 13
- ☐ Only in the bedroom: 6
- ☐ Only in the living room: 2
- ☐ No particular room: 1

For those users who checked multiple locations, the breakdown is as follows:

- ☐ Bathroom and kitchen: 6
- ☐ Bathroom, kitchen, bedroom: 2
- ☐ Kitchen and bedroom: 2
- ☐ Kitchen, bedroom, and hallway: 1
- ☐ Bathroom and bedroom: 1
- ☐ Bathroom, kitchen, and living room closet: 1
- ☐ Bathroom, kitchen, bedroom, hallway: 1

Discussion of Question 8

- ☐ The kitchen and bathroom are the most popular places, with no clear primary location.
- ☐ Six different rooms were employed.



- ☐ 14 users, roughly 27%, keep their medications in more than one place.

9. **Where do you keep your medications (check all that apply)?**

N = 53:

- ☐ In a medicine cabinet 14
- ☐ In drawer 14
- ☐ On the counter 22
- ☐ In the refrigerator 1
- ☐ In my purse/bag/briefcase 8
- ☐ Some place else (please describe) 19
 - *Kitchen cabinet/cupboard*: 9
 - *Kitchen cabinet and dresser*: 1
 - *Kitchen table*: 2
 - *top of dresser and/or nightstand*: 2
 - *desk*: 3
 - *shelf*: 1
 - *Kitchen cabinet;car;top of dresser*: 1
 - One participant responded “*bedroom*”, which we believe was a mis-entry. They had already checked *bedroom* on the previous question.

35 participants checked exactly one box, as follows:

- ☐ Countertop: 14
- ☐ elsewhere: 10
 - *Kitchen cabinet*: 3
 - *Desk*: 3
 - *Kitchen cabinet and dresser*: 1
 - *Top of dresser*: 1
 - *Cabinet*: 1
 - *Bedroom*: 1
- ☐ In a drawer: 8
- ☐ Purse: 2
- ☐ Medicine cabinet: 2

17 participants checked more than one box, as follows:

- ☐ Medicine cabinet and counter: 3
- ☐ Counter and kitchen cabinet: 2
- ☐ Medicine cabinet and purse: 2
- ☐ Refrigerator and *kitchen table*: 1
- ☐ Purse and *kitchen cabinet*: 1
- ☐ Counter and purse: 1
- ☐ Medicine cabinet and *kitchen cabinet*: 1
- ☐ Medicine cabinet and *on a shelf*: 1
- ☐ Medicine cabinet and *kitchen table*: 1
- ☐ Medicine cabinet, purse, and *kitchen cabinet*: 1
- ☐ Medicine cabinet, counter, and *Kitchen cabinet;car;top of dresser*: 1
- ☐ Medicine cabinet, counter, and purse: 1
- ☐ Medicine cabinet, counter, and *top of the dresser and nightstand*: 1



Discussion of question 9

- ☐ *Medicines are kept in many places.* The 53 users mentioned 11 distinct places where they kept their medications. Furthermore, of those that keep their medications in only one place, 10 distinct places were used.
- ☐ *Medicines are rarely kept exclusively in a medicine cabinet.* Only 2 participants, roughly 4%, keep their medicines only in a medicine cabinet.
- ☐ *Medicines are kept on a countertop 51% of the time.* If we sum the answers for “on the counter”, “kitchen table”, “top of a dresser”, “desk”, and “top of dresser”, we get 27 checks for the 53 users.
- ☐ *Medicines are kept on a shelf 49% of the time.* If we sum the answers for “medicine cabinet”, “kitchen cabinet”, and “shelf”, we get 26 checks for the 53 users.
- ☐ *Medicines are rarely kept in the refrigerator.* Our intuition was that this was somewhat common, but only 1 of the 53 users checked this box.
- ☐ *Medicines are often kept in a purse/bag/briefcase.* 8 of the 53 users checked this box.

10. Does someone else keep their medications in the same place you keep yours?

$N = 53$.

- ☐ No: 35
- ☐ Yes: 18

Discussion of question 10

Roughly 34% of the participants shared their medication space with others.

11. Before taking your medications, do you remove any from their original packaging and put them in another container (such as a 7-day pill dispenser)?

$N = 53$.

- ☐ No: 39
- ☐ Yes: 14
 - What kind of container?
 - 7-day pill dispenser: 5
 - smaller container: 3
 - A ziplock bag, when traveling: 2
 - an empty bottle: 2
 - old medicine container: 1
 - plastic: 1

Discussion of Question 11

Roughly 26% of the participants put their medications into an intermediate container before consuming, and they use a variety of such containers.



12. Do you take any medications which should not be taken together?

N = 53.

☐ No: 49

☐ Yes: 4

○ Have you ever taken them together by mistake?

○ No: 4

○ Yes: 0

☐ I don't know: 0

Discussion of question 12

This was the first of a series of questions designed to understand where a lack of knowledge about medications is a problem (whether perceived or actual). Only 8% of the participants claim that they have medications which should not be taken together, and of that 8%, none actually has taken them together by mistake.

13. Do you take medications which advise you to do something afterwards (e.g., eat, drink, nap, avoid the sun)?

N = 53.

☐ No: 28

☐ Yes: 24

☐ I don't know: 1

Discussion of question 13

This was the first of a series of questions designed to understand how useful post-consumption messages would be. Roughly 46% of the participants would have a message to display.

14. Have you ever forgotten to take a prescribed medication?

N = 53.

☐ No: 10

☐ Yes: 43

○ How often in a typical month? (how many times)

○ 20: 1

○ 10: 1

○ 8: 1

○ 6: 2

○ 5: 1

○ 4: 2

○ 3: 1

○ 2-3: 1

○ 2: 5

○ 1-2: 1

○ 1: 18

○ <1: 1



- *once a year*: 1
- *once every 6 months*: 1
- *once in the past 2 years*: 1
- No answer: 5

Discussion of question 14.

The frequency varies widely, but 64% of the participants forget their medications at least once a month. If we map all the “Yes” answers with a frequency of less than once a month to 0 times a month, then the mean frequency is 2.27 – participants who have forgotten at least once, report that on average they have forgotten to take a medication roughly 2.27 times a month. Over all participants, the mean is 1.85.

15. Have you ever chosen to not take a prescribed medication?

N = 53.

- ☐ No: 23
- ☐ Yes: 30
 - Why?
 - *No symptoms*: 11
 - *Unpleasant side effects*: 9
 - *avoid substances in body if possible*: 2
 - *Not the right dosage*: 1
 - *Low confidence in doctor’s diagnosis/prescription*: 1
 - *I was running out and wanted to make them last*: 1
 - *Health reasons*: 1
 - *Conflicting information about side-effects*: 1
 - *Bored; want a change*: 1
 - *Bleeding*: 1
 - *<Illegible>*: 1

Discussion of question 15

Roughly 57% of the participants said that they have at some time deliberately chosen not to take their medication. Among that set, the two most common reasons were (a) side-effects (whether actual or feared) (50%), and (b) lack of perceived need (37%).

16. Has someone (e.g., doctor or nutritionist) asked for a list of all your medications?

N = 53.

- ☐ No: 11
- ☐ Yes: 42
 - Who?
 - *Doctor*: 31
 - *Doctor and dentist*: 4
 - *Doctor and nurse*: 3
 - *Nurse*: 2



- *Athletic trainer*: 1
- *Allergist*: 1
 - Did they want details about when or how frequently you take the medications?
 - $N = 42$
 - Yes: 28
 - No: 14

Discussion of question 16

This question was designed to get information as to how useful a monitoring system would be, that collected medication-taking information to be relayed to a 3rd party (doctor, nurse, etc.). 79% of the participants had someone ask for that information, 53% had someone ask for detailed information.

17. Have you ever had trouble remembering if you already took your medication(s)?

$N = 53$.

- No: 26
- Yes: 27
 - How often?
 - *1 / day* : 1
 - *5 / week*: 1
 - *2 / week*: 2
 - *1-2 / week*: 3
 - *1 / week* : 6
 - *2 / month*: 3
 - *1-2 / month* : 1
 - *1 / month* : 8
 - *Occasionally*: 1
 - *I don't know*: 1

If we remove the single “I don’t know” from the sample, and treat “Occasionally” as “1 / month” (the mode of the other answers), we can then conclude that of the roughly 50% of the participants who have trouble remembering if they already took their medications, they have this problem roughly 3.87 times per month. Including all participants (whether they answered “Yes” or not), we can conclude that the average participant has trouble remembering roughly 1.90 times per month.

Discussion of Question 17

Roughly 50% of the participants report at least some trouble remembering when to take their medications. In question 14, 64% of participants reported that they *had* forgotten to take medications at some point. One would expect the former percentage to be higher than the latter, this may be due to several reasons:

- *Sampling error*. With $N = 53$, the difference between 50% and 64% is not terribly significant.



- ☐ *Different frequency.* While slightly fewer people have trouble remembering whether or not they took their medications than those who actually forget to do so, people have trouble remembering much more frequently (3.87 times per month) than they actually forget (2.27 times per month).

18. When you take your medications, how do you think about which medications to take? (check all that apply)

N = 53.

- You think of the medication's package: 14
- You think of the pill (e.g., "the small blue pill"): 15
- You think of the name of the medication (e.g., "Vitamin C"): 34

Two participants checked no boxes.

42 participants checked exactly one box, as follows:

- Medication name: 26
- Package: 10
- Pill: 6

10 participants checked more than one box, as follows:

- Pill and medication name: 5
- Package, pill, and medication name: 4
- Package and pill: 1

Discussion of question 18

This question was designed to find out which form of feedback users would like to help them identify a particular pill. While the name of the pill was the most popular, all options had significant popularity. Furthermore, 79% of the participants checked exactly one box, implying a strong preference for a certain mode.

19. What is the worst thing that has happened to you regarding your medication?

N = 53.

- Nothing/no answer/NA: 22
- forgetting to take it: 5
- forgetting to take it with me on a trip: 5
- nausea and/or vomiting: 3
- allergy attack: 1
- bad aftertaste: 1
- due to stomach flu, being unable to take them: 1
- forgetting whether or not it was taken: 1
- forgot to get refilled and then needed a drs authorization: 1
- gotten severe headaches: 1
- having to take this survey: 1
- I took too low a dose and didn't control my BP enough: 1



- I took vitamins on an empty stomach and it hurt considerably: 1
- I'm still taking it: 1
- Insurance hassles. Also, there are some medical procedures where you are asked to refrain from taking Meds - I have forgotten this. It would be nice to have a reminder for this. : 1
- long-term use - side effects: 1
- nothing, except maybe now I can't seem to bear pain like menstrual or headache if I don't take some medications: 1
- run out w/o making refill available on time: 1
- skipped an antibiotic by mistake: 1
- taken 2 pills when I was suppose to take one, yet I was okay: 1
- taken a double dose - feeling sick afterwards: 1
- took excedrine migraine too many times for several weeks, developed a caffeine addiction: 1

We combine these into 5 groups, as follows:

- ☐ Nothing: 22
- ☐ Forgetting: 14
- ☐ Side/after-effects: 8
- ☐ Misapplication (taking too many or too few): 4
- ☐ Other: 3

20. What, if any, information would you like to know about your medication (e.g., reactions with other medications, your recommended daily allowance)?

N = 53.

- Nothing/no answer: 22
- reactions with other medications: 8
- side effects: 3
- if ibuprofen can damage my body if taken too regularly
- addiction rates, side effects, long term effects
- all of the above
- am I taking the right amount of vitamins? If what I'm taking may react to some temporary med or over the counter med, if I need to take something else for the vitamin to be absorbed
- As a retired nurse, I always verify possible interactions or side effects.
- effects of overdose
- how helpful are they? I take them because others do
- how many I supposed to take / day
- long term effect on the body / [illegible] effect
- my doctor keeps me informed
- possible side effects, best time of day to take medication
- reaction and interactions, effective dose, purpose and benefits, side effects
- reactions with other medications, long term use
- reactions with other medications, side effects, what happens if more than recommended dosage is taken
- reactions, how many I've taken in the last week



- success rate
- that my pharmacy has filled my order correctly. I have never had any problems with this but have heard various horror stories
- toxicity of vitamin C
- what happens if you take too much
- when I can quit taking them

22. What type of medications do you take? How much of each? How frequently?

This question was designed primarily to let us check the answers to earlier questions. But it does also serve to indicate how many pills people tend to take at a time, and what their frequency patterns are. Many participants didn't answer either or both of those questions, of those who did:

How much of each?

- ☐ 6: 1
- ☐ Up to 6: 1
- ☐ 5: 1
- ☐ 4: 1
- ☐ Up to 4: 3
- ☐ 3: 1
- ☐ Up to 3: 2
- ☐ 2: 10
- ☐ Up to 2: 4
- ☐ 1: 59
- ☐ Up to 1: 1
- ☐ ½: 1

How frequently?

- ☐ Four times a day: 1
- ☐ Three times a day: 1
- ☐ Twice a day: 17
- ☐ Twice a day, three days a week: 1
- ☐ Once a day: 89
- ☐ As needed: 15
- ☐ Every other day: 2
- ☐ No more than 3 days / week: 1
- ☐ Two days / week: 1
- ☐ Once a week: 1
- ☐ Before every dental procedure: 1



Implications for System Design

In this section, we briefly discuss implications of the data in the questionnaire, with a specific focus on the implications for the design of a system which would usefully and successfully monitor medication usage.

- ❑ *Number of medications to track.* From questions 5 and 6, we can see that participants take on average 4.51 different medications, with a minimum of 1 (a prerequisite for being a participant), and a maximum of 12. This has implications for the size and number of monitoring “stations”, if that method is employed.
- ❑ *The role of vitamins.* Roughly 39% of the medications taken are vitamins. Vitamins will be slightly more difficult to track than prescription or over-the-counter medications, as the latter are more likely to carry special manufacturer informational tags (such as RFID tags), due to their cost and control. This implies that systems which rely on RFID tags to monitor medication will either (a) miss 39% of the medications, or (b) require special assistance for vitamins, or (c) will take longer to be feasible than systems which don’t use RFID, such as systems which use bar codes.
- ❑ *Packaging implications.* 86% of the medications were in bottle form, implying that systems should focus most of their energies on this form. A distant second, but still significant, were blister paks (11%). A system which can handle bottles and blister paks would cover 97% of the medications.
- ❑ *Monitoring of liquid medicines not critical.* Only 1% of the medications taken come in liquid form. This implies that a system which measures changes in weight can “coarsen” its monitoring to pill-level, the fine level of weight changes allowed by continuous liquid flow need not be tracked.
- ❑ *Multi-user implications:* while only 7% of *medications* are shared, 34% of participants share the medication *space* (situations where multiple people keep their medications in the same place). This implies that systems should support multiple users, but they will be correct 93% of the time if they rigidly associate a particular bottle with a particular user.
- ❑ *Room implications.* No clear primary room for medications emerged, although two locations (kitchen and bathroom) did predominate. Furthermore, for those users who kept their medications in *only* one location, 4 different locations were mentioned. These facts strongly suggest that a monitoring system must be flexible, deployable in multiple rooms in the house.
- ❑ *Form factor implications.* We were very curious to see whether we could make any simplifying assumptions as to where medications are kept, *within* the room. Are they always kept on a shelf? In a drawer? Where electricity is available? Here again, there was very little consensus. Many medications are kept on a shelf, many are kept in plain sight on a counter-top, and many are kept in a dresser. Each of these three has different industrial design requirements – different heights and widths, different access to electricity, different access to children and pets, etc. These facts strongly suggest that the monitoring system needs to have physical requirements which are as low as possible, and that the best solution will be to have multiple system sensors of different types, optimized for different contexts.



- ❑ *Removing a pill does not imply taking a pill.* 26% of the participants routinely take their pill out of its original container and into an intermediate one. This implies that systems should evolve which can track mixed pills in such intermediate containers. Failing that, systems should recognize that they will often throw “false positives”, thinking a user took a medication when in fact they did not.
- ❑ *Many opportunities for proactivity.* By “proactivity”, we mean a system that reminds or prompts the user as to some activity, as opposed to simply passively monitoring. We can see that many forms of proactivity might be useful:
 - Alerting users to bad interactions (Q 12, applies to 8% of participants)
 - Prompting users as to post-pill activities (Q 12, 46%)
 - Prompting users as to when to take a pill (Q14, 64%)
 - Reminding users whether they took their pills already (Q17, 50%)
 - Notifying users as to side-effects (Q19, 15%; Q20, 42%)
- ❑ *A wide range of proactivities is necessary.* For each of the various places where proactivity *can* be employed, users should have great latitude as to the extent to which it *is* employed. Firstly, some users indicated no desire for systems which act proactively. Secondly, in question 16, we saw that the purely passive role of medicine monitoring for a 3rd party would be quite useful. Thirdly, as we discussed above, the accuracy of such systems will probably not be very high for some time – the only thing worse than a system which “nags” is one which nags mistakenly. Fourthly, we saw a wide range of answers for every one of the activities mentioned above – we cannot generally conclude that any one activity is a “must-have” from a proactive point of view. Fifthly, we saw that a significant number of participants from time to time deliberately choose not to take a medication. Putting all these together, we again conclude that a monitoring system must be as “light on its feet” as possible, accommodating a wide range of possible reminders (including none at all), conveyed in a wide range of mechanisms.
- ❑ *Medication references need multiple formats.* Assuming that the user *does* want notification/reminding as to a particular medication, what form should it be in? We can see from question 18 that each of three different forms is used, and furthermore that each one has a significant number of users who use it *exclusively* – any system which doesn’t support all three references may alienate a significant percentage of users. We see again the need for flexibility within users, as roughly 19% of participants indicated they employ more than one form, suggesting different forms are used to remember different medications.



Appendix: The Original Questionnaire

Intel Research Seattle
1100 NE 45th Street
6th Floor
Seattle, WA 98105



March 2003

Thank you for taking the time to participate in our research study.

The attached questionnaire will be used to help us better understand the needs of potential users of a project we're working on to help people manage their various medications (including vitamins). We hope this will result in a design that is tailored to meet its users' needs. We will be asking a variety of people to complete the questionnaire.

The questionnaire asks some general demographic information, such as age & gender and also asks about your medications (such as your routines for taking medications). Please answer honestly and accurately; your answers will not be used to judge you in any way. Your responses are anonymous, and will be kept confidential. No one outside of the Intel Research project team will have access to the questionnaire you return. Any reports created as a result of the questionnaire will be in aggregate form.

It should take you no more than 15 minutes to complete the questionnaire. Please complete and turn in your questionnaire to **Ken Fishkin** at the address above **by March 21st, 2003**.

When you turn in your completed questionnaire, you will receive a **\$5 gift certificate to Starbucks** as a thank you for your help.

Should you have any questions or concerns about the questionnaire, feel free to contact Ken from Intel Research Seattle. Ken can be reached by email at kfishkin@intel-research.net.

Thanks for your help!

The Intel Research Team



1. Your gender: ☐ Male ☐ Female

2. How old are you?

☐ younger
than 18

☐ 27 – 30

☐ 43 – 50

☐ 31 – 34

☐ 51 – 60

☐ 18 – 21

☐ 35 – 38

☐ 61 – 70

☐ 22 – 26

☐ 39 – 42

☐ 71 or older

3. Where do you live? (City & State) _____

4. What best describes your status (check only one):

☐ Full-time employed

☐ Part-time employed

☐ Unemployed

☐ Homemaker

☐ Retired

☐ Student

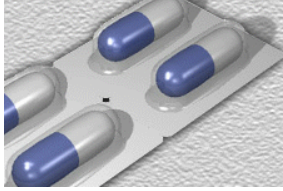


Please read. The following questions ask about your *medications*. This means **any vitamins or prescription/over the counter medication** (including things like aspirin). The medication(s) could be in any form including pill, chewable, liquid, etc.

5. In a typical week, how many different *medications* do you take on a **regular schedule**? _____
- a) How many are prescription medications? _____
 - b) How many are over-the-counter medications? _____
 - c) How many are vitamins? _____
6. In a typical week, how many different *medications* do you take on an “**as-needed**” basis? _____
- a) How many are prescription medications? _____
 - b) How many are over-the-counter medications? _____
 - c) How many are vitamins? _____



7. For the different *medications* you take in a typical week, whether regularly or as-needed, **how many...**

<p>a) come in a bottle? _____</p> <p>b) come in a blister pak? _____</p> <p>c) come in some other packaging? _____ (What kind of packaging? _____)</p> <p>d) are liquid? _____</p> <p>e) are also used by someone else? _____</p>	 <p><i>example of a blister pak</i></p>
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8. In which room(s) do you keep your *medications*? (check all that apply):

- ☐ In the bathroom
- ☐ In the kitchen
- ☐ Other room(s) (Which room(s): _____)
- ☐ I don't keep medications in any particular room

9. Where do you keep your *medications*? (check all that apply):

- ☐ In a medicine cabinet
- ☐ In a drawer
- ☐ On the counter
- ☐ In the refrigerator
- ☐ In my purse / bag / briefcase
- ☐ Some place else (please describe: _____)

10. Does someone else keep their *medications* in the same place you keep yours?

- ☐ No
- ☐ Yes

11. Before taking your *medications*, do you remove any from their original packaging and put them in another container (such as a 7-day pill dispenser)?

- ☐ No
- ☐ Yes (what kind of container? _____)

12. Do you take any *medications* which should *not* be taken together?



- ☐ No
- ☐ Yes (have you ever taken them together by mistake? ☐ No ☐ Yes)
- ☐ I don't know

13. Do you take *medications* which advise you to do something afterwards (e.g., eat, drink, nap, avoid the sun)?

- ☐ No
- ☐ Yes
- ☐ I don't know

14. Have you ever **forgotten** to take a prescribed medication?

- ☐ No
- ☐ Yes (how often in a typical month? ____ times)

15. Have you ever **chosen** to not take a prescribed medication?

- ☐ No
- ☐ Yes (why? _____)

16. Has someone (e.g., doctor or nutritionist) asked for a list of all your medications?

- ☐ No
- ☐ Yes (Who? _____)
- Did they want details about **when** or **how frequently** you take the medications?
 - ☐ No
 - ☐ Yes

17. Have you ever had trouble remembering if you already took your medication(s)?

- ☐ No
- ☐ Yes (How often? ____ per day/week/month [circle one])

18. When you take your *medications*, how do you think about which *medications* to take? (check all that apply)

- ☐ You think of the medication's package



- ☐ You think of the pill (e.g., “the small blue pill”)
- ☐ You think of the name of the medication (e.g., “Vitamin C”)

19. What is the worst thing that has happened to you regarding your medication?

20. What, if any, information would you like to know about your medication (e.g., reactions with other medications, your recommended daily allowance)?

21. What do you do to remember to take your medications?

22. What type of medications do you take? How much of each? How frequently?

for example:

- *1000mg Vitamin C per day – 500mg in the morning and 500 mg in the evening*
- *(2) Multi Vitamins per day – 1 in the morning and 1 in the evening*
- *up to (4) Allegra/day, as needed*



You're almost done...

May we contact you if we have additional questions?

☐ No

☐ Yes

If Yes, please give us your contact information below:

Name _____

Daytime phone () _____

eMail address _____

How would you prefer we contact you?

☐ eMail

☐ phone

☐ no preference

Please return your completed questionnaire to:

**Ken Fishkin
c/o Intel Research Seattle
1100 NE 45th Street
6th Floor
Seattle, WA 98105**

Thank you for your help!

